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“FROM THE FRYING PAN INTO THE FIRE: WORKING ON BOTH SIDES OF THE TOOLING SUPPLY CHAIN”

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ABSTRACT

FOR MANY YEARS I was the consumer of test technology and test tooling at Intel Corporation. In the last year I have jumped from the 'frying pan into the fire'. Now I am the VP of Engineering at Antares Advanced Test Technologies. My responsibilities in this new role include supplying the test tooling needs for many customers.

This experience in the role of supplier has been a learning experience. Having spent time in both roles I can compare and contrast the challenges of both supplier and customer. My intent in this presentation is to highlight the issues and challenges that occur when suppliers have to respond to the demands of customers.

At the root of these issues are always the assumptions that are made by the customers with respect to the capabilities of suppliers and vice versa. Differences are abound in technology, measurement, supplier management, effectiveness of customer specifications, mid-stream design and requirements changes and risks that can be assumed as well as political considerations for all parts of the supply chain.

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**From the frying pan
into the fire:
Working on both sides
of the tooling supply
chain**

Steven B. Strauss
Antares Advanced Test Technologies
Vice President of Engineering



Thank You Mark Murdza



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Introduction

- For many years I was the consumer of test technology and test tooling at Intel Corporation
- Now I am at Antares Advanced Test Technologies responsible for the development, design and delivery of test tooling to customers
- Having spent time in both roles I can now compare and contrast the challenges of being both a supplier and customer of tooling

Did I jump from the frying pan into the fire?

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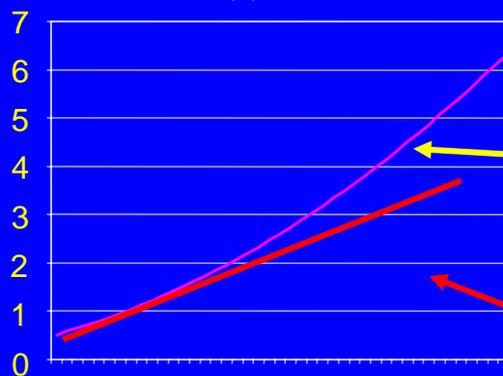
Being a Semi Supplier

Semiconductor Suppliers are 2nd Derivative Businesses

$$f(x) = x^2$$

$$f'(x) = 2x$$

$$f''(x) = 0$$



If Semi Industry Growth = x^2

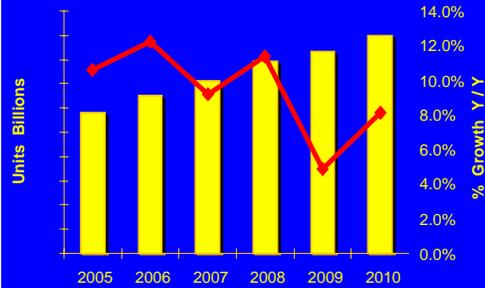
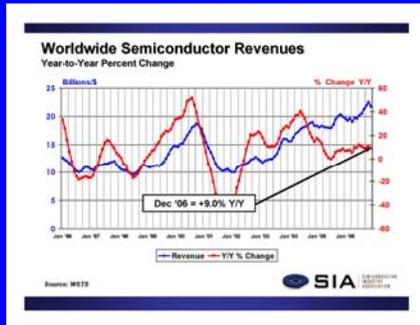
Then Semi Supplier Industry Growth is linear

Suppliers growth depends on the rate of change of the semi industry, not the size of the semi industry at a given point in time

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The Semiconductor Outlook

Unit Growth is Outpacing Revenue Growth



Source: Gartner

"The outlook for the chip market has improved **slightly**. We still predict four years of **modest growth**, a slight fall in 2009 and a rise in 2010. But the compound annual growth rate for **2004 to 2010 has risen to 7 percent**" – Gartner 2/2007

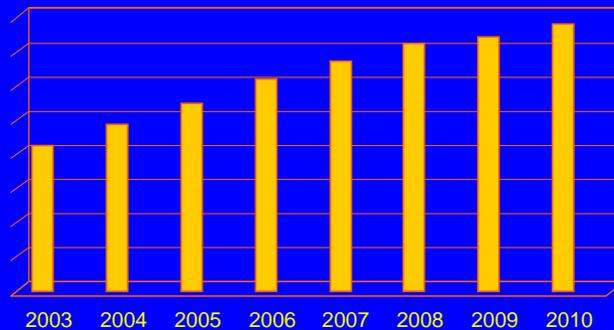
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A Semi Supplier in the Socket Business

Test Socket Market CAGR : ~8.3 %



\$M



- High Mix, Low Volume, Custom product
- Technology as a commodity
- Customers don't look at CoO, Acquisition costs driven purchasing
- Small percentage in the overall Test cost
- Slow rate of new technology creation and adaptation
- Migration to ball and pad
- Generational cost reduction
- ASP erosion with increased pin count

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A Quick Survey

- How many of you work for companies that are:
 - Fewer than 100 employees ?
 - Between 101 and 300 employees ?
 - Between 300 and 1000 employees?
 - Greater than 1000 employees?

Scale



Big vs. Little: The obvious?

Big

- More structured
 - Large cross geographical teams
- High level of specialization in organizations
- Support structure
 - HR, IT, Facilities, Legal
- Internal upward mobility
- Highly structured communications in and hierarchical in nature
- Funding pain at higher level

Little

- Employees are generalists
 - Yet have to have skills and leadership capabilities to lead a wide variety of initiatives
- Engagement in multiple projects
 - Gain experience in developing multiple skill sets
- Direct voice in company projects and directions
- Less formal structure and operating procedures
- Chaotic structure is the norm

From the largest semiconductor company to the largest tooling company

Little Fish in a Big Pond

- Test Tooling expectation was **never** be a limiter to HVM or development
 - Technology
 - Capacity
 - Cost
- Many Tools worldwide
 - Engineers / Techs
 - Facilities and Labs
- Infrastructure
 - Selection teams
 - Supplier management
 - User groups
 - Commodity management



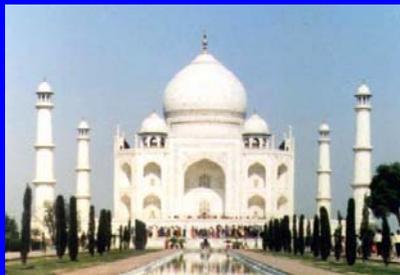
Big Fish in Little Pond

- Customer Driven
 - Cost, Technology, OTD...
 - Even if the customer doesn't know what they want
 - Extremely cost effective
- Utilization of tools is precious
 - Handlers, VNA's, Ovens
 - OFA, PCW...
- Resources
 - Everyone wears more hats
 - Development, Design, Validation, Supplier management

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First Impression: Tools and Labs

- Facilities and Money
 - Multiple labs at Intel
 - <\$100K was no issue
 - Handlers, Thermal control systems, Scopes were standard fare
 - Plenty of test units, engineering samples, Thermal test vehicles.....



- Well equipped but...



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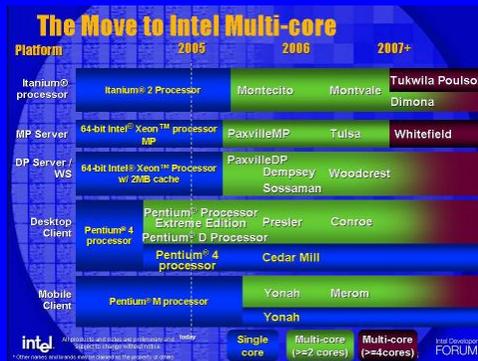
First Impression: Tools and Labs



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Planning for the Future

- Intel is sophisticated: Roadmaps exist for Products, Processes, Technology, Equipment...



Source: Intel Roadmap Published at IDF

- Future socket requirements?
- Next Generation package requirements?
- Technical roadmaps?



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Supplier Relationships

- Intel represents a huge revenue and volume opportunity
- Structure – Best in class
 - Contracts
 - Aggressive cost targets
 - Competitive selection
 - Report cards
- Impact on the supplier
 - High maintenance customer
 - Multiple sources of components



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Supplier Relationships

Challenges

- Feast and Famine demand
- Constantly changing technical requirements
- Fast OTD requirements
 - Days or Weeks not Months
- Constantly decreasing cost expectations
- Constantly increasing technical requirements
- Suppliers view customers our size very differently
 - Revenue and volume from Antares to our suppliers doesn't justify the same kind of commitment

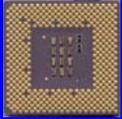
Antares WHO?



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PGA, LGA, BGA aren't the only packages in the world?

How I used to see the package world...



PGA / LGA



BGA



CSP

How I see the package world today...

PGA LGA BGA CSP	QFP QFN SOIC TSOP DIP
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- What is a QFN?
- Didn't we stop using QFP with the 386SX?
- Isn't CSP just for Flash and Cell Phones?

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Who are these guys?



Johnstech



PLASTRONICS



Loranger International

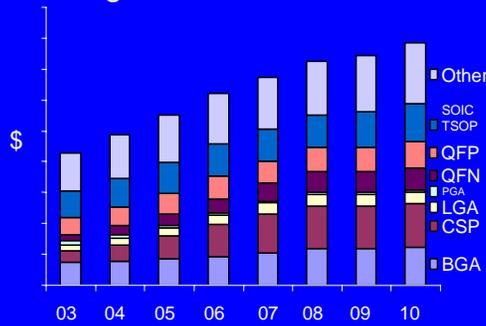
Are there companies whose business doesn't revolve around LGA's, PGA's or BGA's ?

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PGA, LGA, BGA aren't the only packages in the world ?

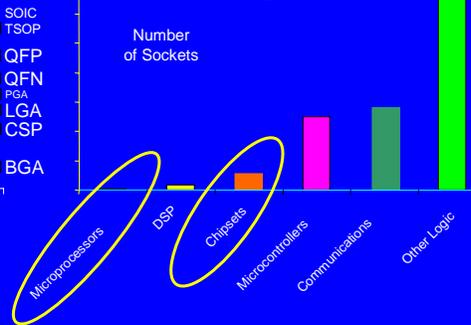


"Big Iron" Test Socket TAM



QFN is 2.5X LGA

Test Socket TAM by Market Segment

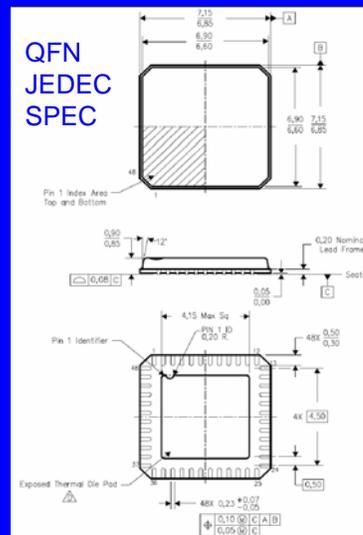


Package Specs and Variation

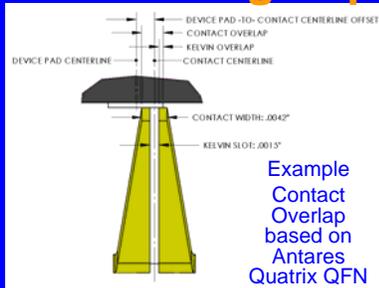


Assumptions

- Package size distribution is well understood
- Socket suppliers CAN design successfully based upon these requirements



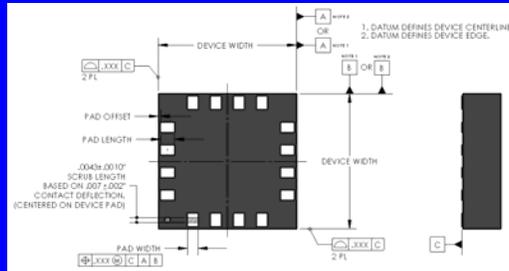
Package Specs and Variation



Example
Contact
Overlap
based on
Antares
Quatrix QFN

Contact Overlap = (1/2 Minimum pad width) – (Contact – to – device pad centerline offset) + (1/2 Contact width)

Worst Case Package tolerances guarantee that you will miss the pad



- The largest contributor to the tolerance stacks comes from tolerances associated with the device
- The overall device size tolerance as well as pad location tolerance is often enough to produce a stack that prevents mating contact.

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Conclusions

- Transition from customer to supplier....
- From a market leader with a dominant position to a leading supplier in a highly fragmented competitive market
- Key learning:
 - HMLV Custom Competitive business
 - Careful investment... Percentage of successes and payouts has to be higher
 - Achieved with fewer resources
 - Less consistency and few real standards among customers
- Challenging Business and Technology
 - Huge opportunities for technical and commercial innovation, CoO benefit for customers in a market that is mature and growing

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